Lectures in Monetary Economics

Lecture 5

Deviations from perfect price stabilization: Caveats

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Deviations from perfect price stabilization: Caveats

- The existence of nominal frictions (money is "essential")
- The zero nominal interest rate lower bound
- Asymmetries across sectors
- Wage and price rigidities

When money is essential: The Friedman rule often describes optimal monetary policy:
Set $R = 0 \rightarrow \pi < 0$

But setting $\pi < 0$ thus leads to price dispersion which is inefficient.
Allowing R_t to differ from zero and vary is distortionary too.
Need to trade one distortion against the other. Woodford, 2003, shows that in this case, the welfare maximizing objective of the central bank takes the form

$$\Omega_t = \pi_t^2 + F_y(\widehat{y}_t^e)^2 + F_i\widehat{R}_t \tag{1}$$

Optimal policy also involves some interest rate smoothing!

General properties of policy:

- A small deviation from zero inflation (small deflation)
- Also some variability in inflation
- The targeted interest rate is below the one which would be consistent with zero inflation

The targeted interest rate is above the one which would be consistent with zero inflation

Practical relevance of the zero bound.

The case of Japan. Was the zero bound operational? Eggertson-Woodford: Construct a simple model that suggests that the zero bound constraint could have mattered a lot. They suggests a solution to the problem: *Price level targeting*.

Does the lower bound still matter in models that incorporate investment and an open economy? (Christiano, 2005). Not really.

What does the lower bound imply for the effectiveness of fiscal shocks? Very large government spending multiplier.

Monetary union

Basic principles in the conduct of policy:

- We want the relative price (the real exchange rate) to mimic that under flexible prices.
- We also want price stability-elimination of the output gap in each country (in order to take care of within country relative price distortion and the variable markup).

1. If prices are equally sticky and the economies are symmetric then optimal monetary policy entails stabilizing the aggregate inflation rate. The relative price is independent of monetary policy
2. In general, a policy that targets aggregate inflation at the level (Benigno, 2003)

$$\pi_t^{TAR} = m\pi_{1t} + (1-m)\pi_{2t} \tag{2}$$

   is a good approximation to the optimal policy.
3. Larger countries and countries with more sticky prices receive a larger weight.

Because food, energy and asset prices are quite flexible:

- Justification for core inflation targeting (Aoki, 2001).
- Justification for not including asset price inflation in the inflation target.

Wage rigidities

Erceg, Henderson and Levin, 2000

Target wage rather than price inflation.

Case 2: The flexible price equilibrium is not efficient ($Y_t^N \neq Y_t^e$) but the steady state is $Y^N = Y^e$.
Case of exogenous markup fluctuations + employment subsidy
Rewrite the IS and Phillips curves in terms of the appropriate output gap, $\widehat{y_t^e} = log(Y_t) - log(Y_t^e)$.

$$IS: \ \widehat{y}_t^e = E_t \widehat{y}_{t+1}^e - \frac{1}{\gamma}(\widehat{R}_t - E_t \pi_{t+1} - \widehat{r}_t^e) \tag{3}$$

$\widehat{r}_t^e = log r_t^e - log\beta$ where r_t^e satisfies $(Y_t^e)^{-\gamma} = \beta E_t r_t^e (Y_{t+1}^e)^{-\gamma}$.

$$PC: \ \pi_t = \beta E_t \pi_{t+1} + \kappa \widehat{y}_t^N = \beta E_t \pi_{t+1} + \kappa \widehat{y}_t^e + v_t \tag{4}$$

$v_t = \kappa(log Y_t^e - log Y_t^N)$, independent of policy.

Perfect price stabilization does not eliminate the welfare relevant output gap. Hence, there may be a trade off between price and output stability (the discrepancy between the current output and the efficient level of output).

What is the practical relevance of this trade off?

Does the central bank have the efficient (or even the natural) level of output as its stabilization target?

With a trade off between the two objectives of price and output stability, the distinction between *discretionary* and *rule* based policy becomes important. Given expectations, the policymaker may be tempted to deviate from previously announced plans.

A. Optimal policy under discretion

The CB cannot credibly commit to any future policy. Its current actions cannot influence expectations about future inflation and output. In selecting the current action it takes $E_t\pi_{t+1}$ as given. It minimizes

$$L_t = \kappa(\widehat{y}_t^e)^2 + \theta\pi_t^2 \tag{5}$$

subject to

$$\pi_t = \kappa\widehat{y}_t^e + N_t \tag{6}$$

where $\widehat{y}_t$ is the relevant welfare gap and $N_t = \beta E_t\pi_{t+1} + v_t$.

When v_t is iid the optimal solution satisfies

$$\begin{aligned} \pi_t &= \left(\frac{1}{1+\kappa\theta}\right) v_t \\ \widehat{y}_t^e &= -\left(\frac{\theta}{1+\kappa\theta}\right) v_t \\ \Rightarrow \widehat{y}_t^e &= -\theta\pi_t \end{aligned} \tag{7}$$

Key property: Let output decline following an adverse v shock. *Split* the effects of the shock between output and inflation.

If v_t is $AR(1)$ $\pi_t = \Phi v_t$, $\widehat{y}_t = -\theta\Phi v_t$, $\Phi = \frac{1}{1+\theta\kappa+\beta\rho}$
The implied nominal interest rate is

$$\widehat{R}_t = \widehat{r}_t^e + \left(\frac{\gamma\theta}{1+\kappa\theta}\right) v_t \tag{8}$$

Implementation of policy via an interest rate rule

$$\widehat{R}_t = \widehat{r}_t^e + \left(\frac{\gamma\theta - k_\pi}{1 + \kappa\theta} v_t + k_\pi \pi_t \right) \tag{9}$$

$k_\pi > 1$ guarantees uniqueness.

Practical difficulty of implementing such a procedure.

One could think in terms of targeting rules: Use the CB instruments to induce $\widehat{y}_t^e = -\theta\pi_t$ rather than try to follow equation (9). But this still requires knowledge of the efficient level of output.

B. Optimal policy under commitment (a rule)
Monetary policy is credible and the CB can commit to a future course of actions.

The CB chooses a state contingent path of inflation and output gaps in order to minimize

$$\Omega = 0.5E_0 \sum_{t=0}^{\infty} \beta^t L_t = 0.5E_0 \sum_{t=0}^{\infty} \beta^t \left(\kappa(\widehat{y}_t^e)^2 + \theta\pi_t^2\right) \tag{10}$$

subject to the Phillips curve constraint

$$\pi_t = \beta E_t \pi_{t+1} + \kappa \widehat{y}_t^e + v_t \tag{11}$$

The choice of π_t and $\widehat{y}_t^e$ satisfy

$$\widehat{y}_t^e = \lambda_t \quad (12)$$

$$\theta\pi_t = \lambda_{t-1} - \lambda_t \quad (13)$$

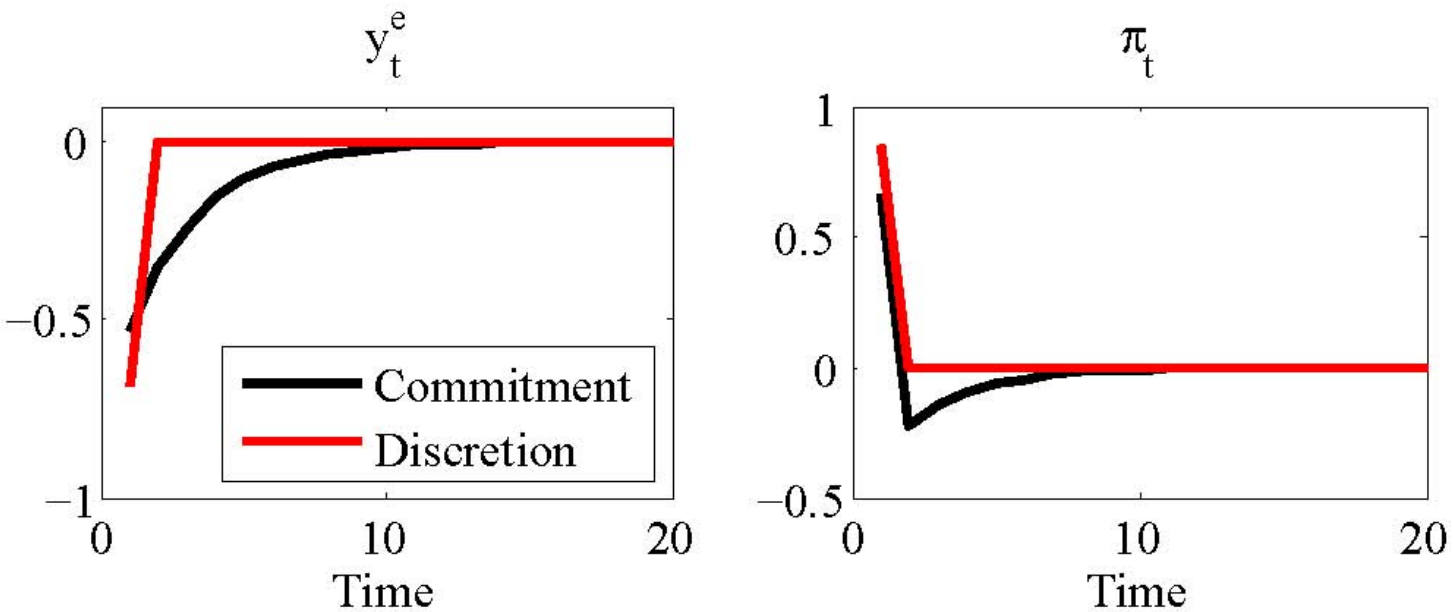
The importance of the presence of the Lagrange multiplier of period $t-1$ in the optimal choice of policy in period t. Past commitments are honored!

$$\widehat{y}_t^e = -\theta(logP_t - logP_{-1}) \equiv -\theta\hat{p}_t \tag{14}$$

The optimal path of the price level

$$(1 + \beta + \kappa\theta)\hat{p}_t = \hat{p}_{t-1} + \beta E_t\hat{p}_{t+1} + v_t \tag{15}$$

Figure: Discretion vs Commitment



Main observation: The CB gets a better trade off between inflation and output at the time of the shock under commitment. This is valuable because of the convexity of the objective function.

C. The management of expectations

Comparison of the analysis to the traditional literature on credibility (Barro and Gordon)

Distorted steady state (too low output).

Case 1: Small distortions

Implications for solution strategy: Log linear approximation to the model is still a valid procedure.

Properties of policy

Under discretion

Same response to the cost push shock as in the undistorted SS case.

Inflation bias: Positive average inflation to erode the mark ups of the firms that have fixed prices and lead to higher output. The optimal average inflation rate is increasing in the degree of inefficiency.

Inflation leads to price dispersion which is inefficient. This limits the CB's appetite for inflation.

Under commitment

The response to the cost push shock is the same as under discretion.

Asymptotically, the average inflation converges to zero from above. Hence, policy commitment eliminates -asymptotically- the inflation bias.

An application to currency union (Clerc, Dellas, Loisel, JIE, 2010)

- Monetary union can benefit countries suffering from policy credibility problems if it eliminates the inflation bias and also allows for more efficient management of certain shocks.
- But it also carries costs as *some* stabilization may be feasible even in the absence of credibility, and this may be more than what an individual country can hope for in a monetary union.

C-D-L combine the stabilization and credibility branches of the currency union literature and construct a simple welfare criterion that can be used to evaluate alternative monetary arrangements. They produce examples where monetary union may be welfare improving even for low-modest levels of inflation bias (2-3%) as long as business cycles are not too a-synchronized across countries.

The model

- A small open economy
- Unitary elasticities
- Phillips curve (cost-push) and IS shocks
- CB in the small, open economy lacks credibility (follows discretion)
- CB of the currency union enjoys credibility

Welfare function in the small economy

$$L_t = E_t \left\{ \sum_{k=0}^{+\infty} \beta^k \left[\left(\Delta p_{H,t+k} \right)^2 + \delta \left(\widehat{x}_{t+k} - \chi \right)^2 \right] \right\}, \qquad (16)$$

In the currency union

$$L_t^* = E_t \left\{ \sum_{k=0}^{+\infty} \beta^k \left[\left(\Delta p_{t+k}^* \right)^2 + \delta \left(\widehat{x}_{t+k}^* - \chi^* \right)^2 \right] \right\}, \qquad (17)$$

Flexible exchange rate with optimal discretionary policy

$$\Delta p_{H,t} = \frac{\kappa\delta\chi}{\kappa^2+\delta(1-\beta)} + \frac{\delta u_t}{\kappa^2+\delta(1-\beta\rho_u)} \quad (18)$$

$$\text{and } \widehat{x}_t = \frac{\delta(1-\beta)\chi}{\kappa^2+\delta(1-\beta)} - \frac{\kappa u_t}{\kappa^2+\delta(1-\beta\rho_u)}, \quad (19)$$

Unconditional mean of the loss function:

$$L^{flex} = \frac{\kappa^2\delta\left(\kappa^2+\delta\right)\chi^2}{(1-\beta)\left[\kappa^2+\delta(1-\beta)\right]^2} + \frac{\delta\left(\kappa^2+\delta\right)V_u}{(1-\beta)(1-\rho_u^2)\left[\kappa^2+\delta(1-\beta\rho_u)\right]^2}. \quad (20)$$

Currency union

$$\begin{aligned}\Delta p_{H,t} &= -\kappa\theta\varepsilon_t^a + \kappa(1-\theta)\sum_{k=1}^{+\infty}\theta^k\varepsilon_{t-k}^a \\ &\quad +\theta\varepsilon_t^u - (1-\theta)\sum_{k=1}^{+\infty}\theta^k\varepsilon_{t-k}^u \\ &\quad +\kappa\theta\varepsilon_t^{a^*} - \kappa(1-\theta)\sum_{k=1}^{+\infty}\theta^k\varepsilon_{t-k}^{a^*} \\ &\quad +\sum_{k=0}^{+\infty}\left[(1-\theta)\theta^k - (1-\omega)\omega^k\right]\varepsilon_{t-k}^{u^*} \qquad (21)\end{aligned}$$

$$\begin{aligned}\text{and } \widehat{x}_t &= -(1-\kappa\theta)\varepsilon_t^a + \kappa\sum_{k=1}^{+\infty}\theta^{k+1}\varepsilon_{t-k}^a - \sum_{k=0}^{+\infty}\theta^{k+1}\varepsilon_{t-k}^u \\ &\quad +(1-\kappa\theta)\varepsilon_t^{a^*} - \kappa\sum_{k=1}^{+\infty}\theta^{k+1}\varepsilon_{t-k}^{a^*} \\ &\quad -\sum_{k=0}^{+\infty}\left[\frac{\kappa}{\delta}\omega^{k+1} - \theta^{k+1}\right]\varepsilon_{t-k}^{u^*} \qquad (22)\end{aligned}$$

Unconditional mean of the loss function of the small open economy

$$
\begin{aligned}
L^{mu} = & \frac{\delta\chi^2}{1-\beta} + \frac{V_a + V_{a^*} - 2\mu_a}{1-\beta}\left[\frac{2\kappa^2\theta^2}{1+\theta} + \delta - 2\kappa\delta\theta + \frac{\kappa^2\delta\theta^2}{1-\theta^2}\right] \\
& + \frac{\theta^2 V_u}{(1-\beta)(1+\theta)}\left[2 + \frac{\delta}{1-\theta}\right] + \frac{V_{u^*}}{1-\beta}\left[\frac{1-\theta}{1+\theta} + \frac{\delta\theta^2}{1-\theta^2}\right. \\
& \left. + \frac{1-\beta\omega^2}{1+\omega} - \frac{2(1-\theta)(1-\omega)}{1-\theta\omega} - \frac{2\kappa\theta\omega}{1-\theta\omega}\right] \\
& - \frac{2\theta\mu_u}{1-\beta}\left[\frac{2\theta}{1+\theta} + \frac{\delta\theta}{1-\theta^2} - \frac{\omega(2-\theta-\omega)}{1-\theta\omega} - \frac{\kappa\omega}{1-\theta\omega}\right] \quad (23)
\end{aligned}
$$

Table: Welfare comparisons of alternative regimes: The case of a 3% inflation bias

	$\sigma_u = 0.001, \sigma_a = 0$	$\sigma_u = 0, \sigma_a = 0.001$	$\sigma_u = 0.001, \sigma_a = 0.001$
corr =0.9	+1.4645	+0.7364	+1.4616
corr =0	+0.2033	+0.6818	-0.2113
corr =-0.9	-1.4360	+0.6225	-1.4918

[a] The numbers represent the inflation equivalent of moving from a float under discretion to monetary union under commitment. A + means a welfare gain and a − a welfare loss. There is an annual inflation bias of 3% under discretion in the flexible regime. u is the cost push and a the productivity shock. σ represents variance.

Case 2: Large distortions

Implications for solution-evaluation strategy:

For a quadratic approximation to utility to produce accurate results may need second order approximation to the model.

Basic principles of optimal policy: Collard and Dellas, JME (2005, 2006)

- Inflation vs price targeting (inflation vs price stability).
- If non-optimizing firms index their prices to steady state inflation then there is no price dispersion in this steady state. If the steady state is efficient and there are no cost push shocks then any constant rate of inflation is optimal and consistent with a zero output gap.
- If the steady state is distorted because of the existence of a monetary friction, then the Friedman rule calls for deflation.
- In practice, small optimal deviations from perfect inflation targeting.